THE NATIONAL SHIPBUILDING RESEARCH PROGRAM

REAPS 5th Annual Technical Symposium Proceedings

Paper No. 6: Detail Engineering Module (DEMO) and Other SPADES Developments

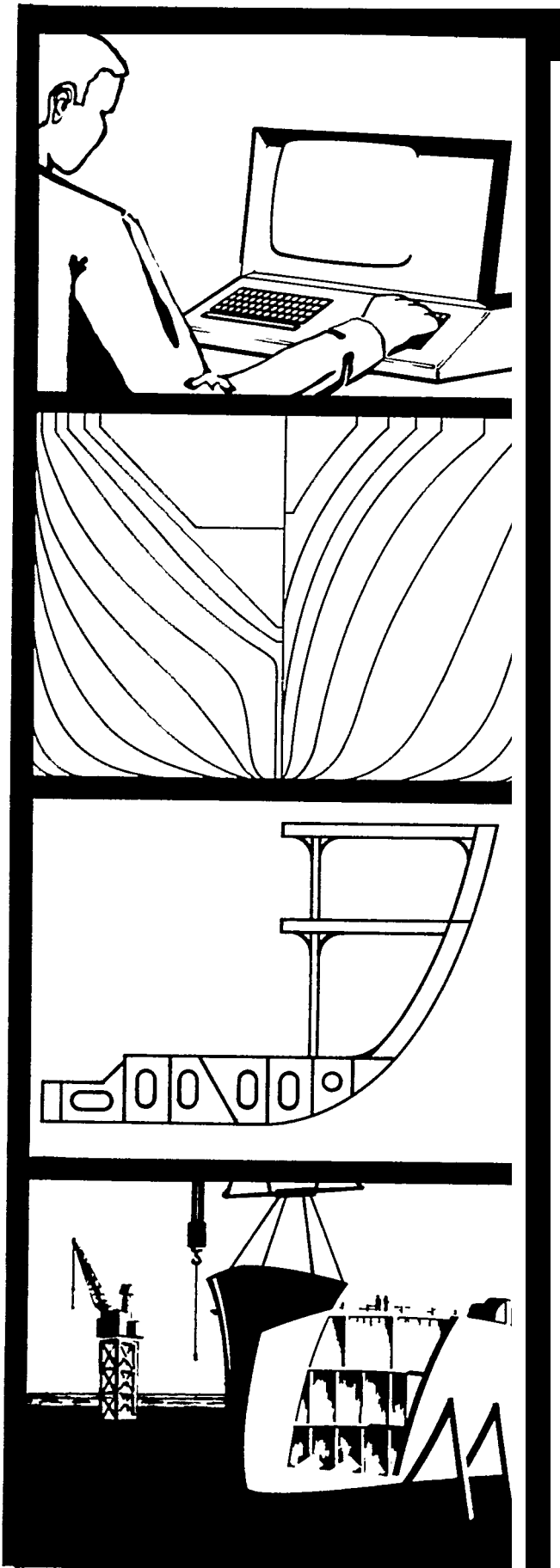U.S. DEPARTMENT OF THE NAVY
CARDEROCK DIVISION,
NAVAL SURFACE WARFARE CENTER

		Form Approved
Report Documentation Page		*OMB No. 0704-0188*

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1. REPORT DATE **JUN 1978**	2. REPORT TYPE **N/A**	3. DATES COVERED **-**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
The National Shipbuilding Research Program REAPS 5th Annual Technical Symposium Proceedings Paper No. 6: Detail Engineering Module (DEMO) and Other SPADES Developments	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Naval Surface Warfare Center CD Code 2230 - Design Integration Tools Building 192 Room 128 9500 MacArthur Blvd Bethesda, MD 20817-5700**	8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT **SAR**	18. NUMBER OF PAGES **46**	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**			

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std Z39-18

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P | RODUCTIVITY
    | IN
S | HIPBUILDING

Proceedings of the

REAPS Technical Symposium

June 27-28, 1978

St. Louis, Missouri

DISCLAIMER

DETAIL ENGINEERING MODULE (DEMO)
AND OTHER SPADES DEVELOPMENTS

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DETAIL ENGINEERING MODULE

When we planned the Detail Engineering Module some time ago, we had set three objectives to be achieved:

1. The verification of the data base loading by means of drawings which can be extracted with a few commands.

2. The development of a powerful program oriented towards engineering needs, which could be utilized in generation of the detail drawings.

3. Expanded data base loading and recalling capabilities for the entire 'SPADES' System beyond the mere wire model, to include details of holes, stiffeners, seams, brackets and internal contours.

Today, I am able to report that the first two objectives have been accomplished. In fact, the Detail Engineering Module is being used already in a production environment at a major shipyard.

In order to show you how the Detail Engineering Module can be utilized, I have worked out a little demonstration with one of the lofting contracts our Company is performing at the present time. The vessel is a Patrol Gunboat of the PGG 511 class, which measures 190 feet in length, and about 26 feet in beam. The lines of the boat have been computer faired

by the 'SPADES' Fairing Module, and loading of the data base has been performed with the HULLOAD Module for the purpose of lofting.

Partially to check out the hulloading job, and partially to find out how much the Detail Engineering Module could produce, I called out a series of side frames with this input deck (Fig. 1). The result is a drawing (like Figs. 2, 3 and 4) for each of the frames. Each of the drawings has its unique identification number, composed of the ship number, program number (DEMO), the input deck number, and a modifier within the input deck and the actual frame number.

The actual detail drawings of this contract show this series of side frames drawn on top of each other, which prompted me to do the same thing with Fig. 5 as a result. This picture looks somewhat confusing at first. But it reveals the value of the program as a data base checking tool. It would be immediately visible if a longitudinal has the wrong location, orientation or size. In fact, we were puzzled by the irregular pattern of the Tee's on the first platform. Another new development of the 'SPADES' System, the Shipfile Verification Report, helped immediately to clear up the mystery. This report lists all longitudinals by characteristics (Fig. 6), and longitudinals L10 and L9 are shown sloping outboard in the frame range in question.

Next, I tried 'DEMO' for three web frames, 26.1, 31 and 35 (Figs. 7 through 10), and Bulkhead 22 (Figs. 11 & 12). The Bulkhead shows an

optional grid that may be called out for the purpose of orientation and reference in detailing.

Now, I would like to show you how 'DEMO' could be used for detailing. Again, I started out by simply calling three webframes, 7, 12 and 17, from the data base (Figs. 13 through 16). It is apparent that Frame 7 is somewhat different from Frames 12 and 17 because of the breasthooks that land against it in the lower portion. But the webs are still similar, and coding can be identical for all three frames. In the Deck No. 2 (Fig. 17), the internal contours of side web and deck web are coded. I have added some writing through the drafting machine and then terminated Frame 7. The result is Fig. 18. Following the 'LOAD' card for Frame 7 is some coding to complete the detailing of Frames 12 and 17. Some minor calculations precede the definition of four holes, and other calculations are followed by the definition of the five horizontal stiffeners. Figs. 19 and 20 show the results for Frames 12 and 17.

Input Deck 4 (Fig. 21) is a slight modification of Input Deck 2. The Command 'LIMT' has been added in order to cut the drawings just above the Platform. Figs. 22, 23 and 24 show the result. This could be useful if the lower portion of the Web is needed to be drawn at a larger scale for detailing.

Finally, the contract drawings showed two details. One is the cut-out at the shell knuckle in a very large scale. Input Deck 3 (Fig. 25) shows the

coding necessary for that detail (Fig. 26). The other detail is the connection of the deck and side webs. Input Deck 5 (Fig. 27) was generated by a copy from Deck 2, deletion of unnecessary coding like the holes and stiffeners, and addition of the 'LIMT' Command. Fig. 28 shows detail 5B.

The drawings that are generated by 'DEMO' at the shipyard enjoy great popularity and are hard to come by. I was able to get hold of a few, which I would like to show you as samples of application.

Fig. 29: Two partial webframes of a Navy Tanker

Fig. 30: Partial stern frame of a Container Ship

Fig. 31: Midship section of a Tank Barge.

```
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     INPS                       N       10                                    7300100008
     LIMT                                         X    12      Y    1         7300100012
     DRWG TRSV          FWD     F 231     F 251     F 271      F 291          7300100016
                                F 321     F 341     F 381                     7300100020
     RMKS SIDE FRMS. STBD LKG FWD PORT SIM & OPP                             7300100028
     STRT                       -4         -10                               7300100032
     LOAD                       F 231     F 381                              7300100036
                                                                            7300100040M
                                                                            7300100044M
                                                                            7300100048M
                                                                            7300100052M
                                                                            7300100056M
                                                                            7300100060M
     INPE                                                                    7300109999
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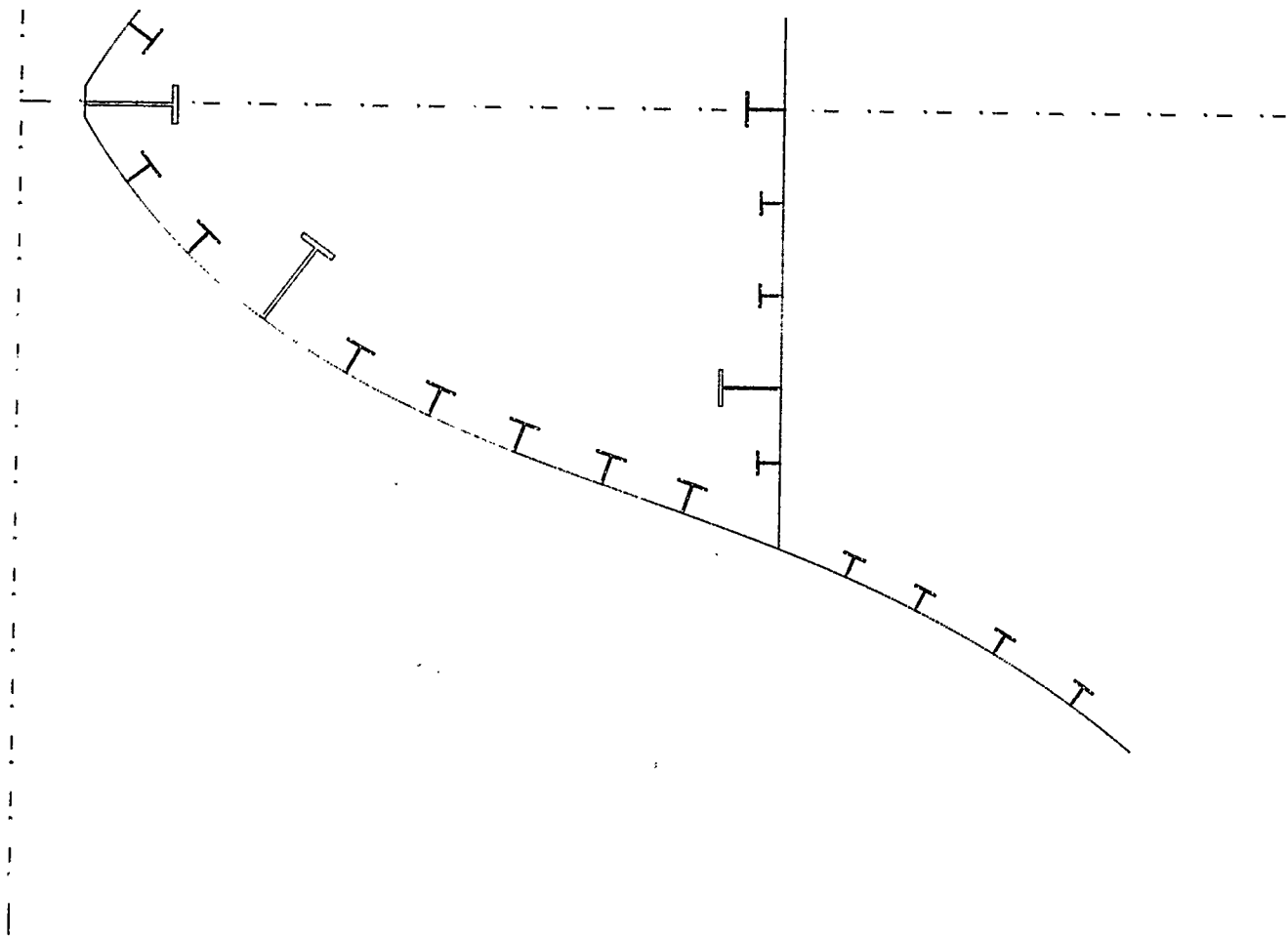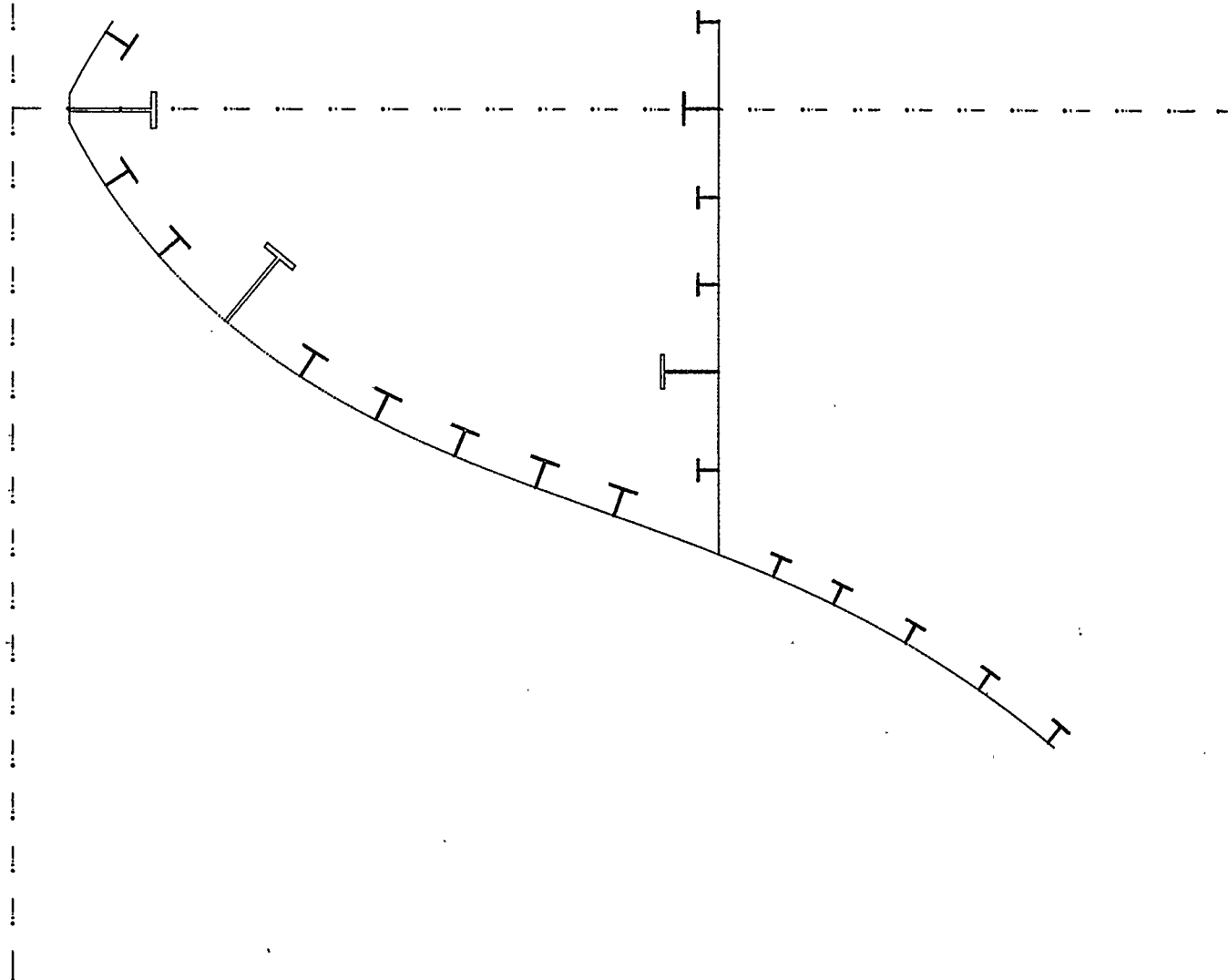
Fig. 1

Fig. 2

151

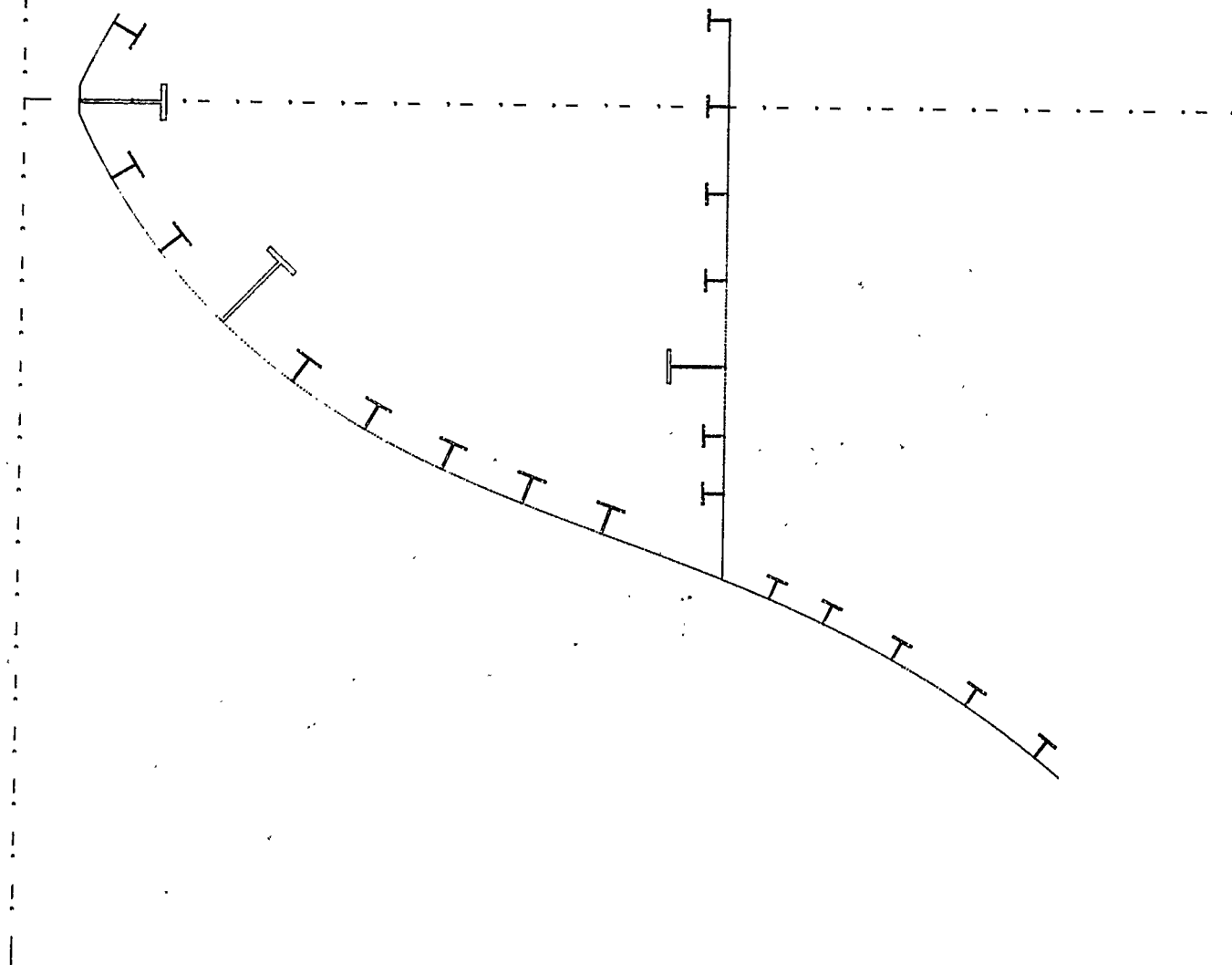TAPE NO.   730010   - 2 F   23100

Fig. 3

152

TAPE NO. 731010 − 2 F 25100

Fig. 4

153

TAPE NO. 732010 — 2 F 27100

Fig. 5

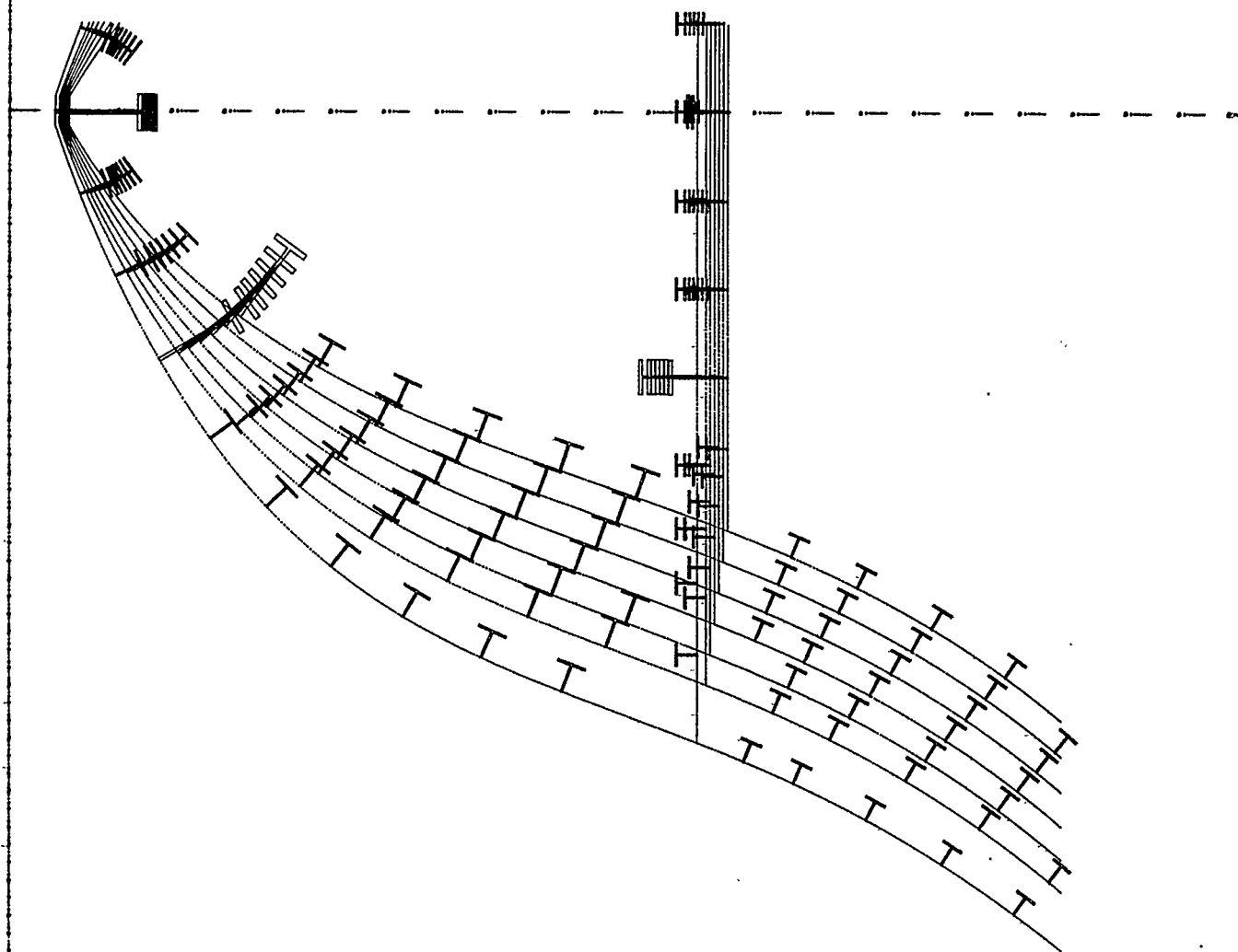154

S L10	4100 TO	7600	SLPE	Y	0.487	1.003 K	100	903	NORM	180.000
	8100 TO	9100	SLPE	Y	1.249	1.495 K	100	903	NORM	180.000
	10100 TO	12000	SLPE	Y	1.726	1.958 K	100	903	NORM	180.000
	13100 TO	17100	SLPE	Y	2.175	2.825 K	100	903	NORM	180.000
	18100 TO	22000	SLPE	Y	3.051	3.651 K	100	903	NORM	180.000
	23100 TO	26100	SLPE	Y	3.811	4.291 K	100	903	NORM	180.000
	27100 TO	31000	SLPE	Y	4.467	4.996 K	100	903	NORM	180.000
	32100 TO	35100	SLPE	Y	5.166	5.676 K	100	903	NORM	180.000
	36100 TO	38100	SLPE	Y	5.835	6.154	100	903	NORM	180.000
	40000 TO	40000	FLAT	Y	6.314	6.314	-101	903	NORM	180.000
	41050 TO	43100	SLPE	Y	6.526	6.774 K	100	903	NORM	180.000
	46000 TO	47000	SLPE	Y	7.157	7.269 K	100	903	NORM	180.000

Fig. 6

```
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  INPS                     N      11                                      7300110008
  LIMT                                                     Y     2        7300110012
  DRWG TRSV        FWD    F 261      F 31       F 351                      7300110016
  RMKS WEB FRMS                                                           7300110020
  STRT                      -3        -13                                 7300110024
  WRIT3                    -2 3        0     A -90              3          7300110028R
  WRIT3WEB FRAME        STBD LOKG FWD PORT SIN & OPP            *          7300110032R
                                                                          7300110036D
  LOAD                   F 261      F 351                                 7300110040
  INPE                                                                    7300119999
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Fig. 7

156

WEB FRAME

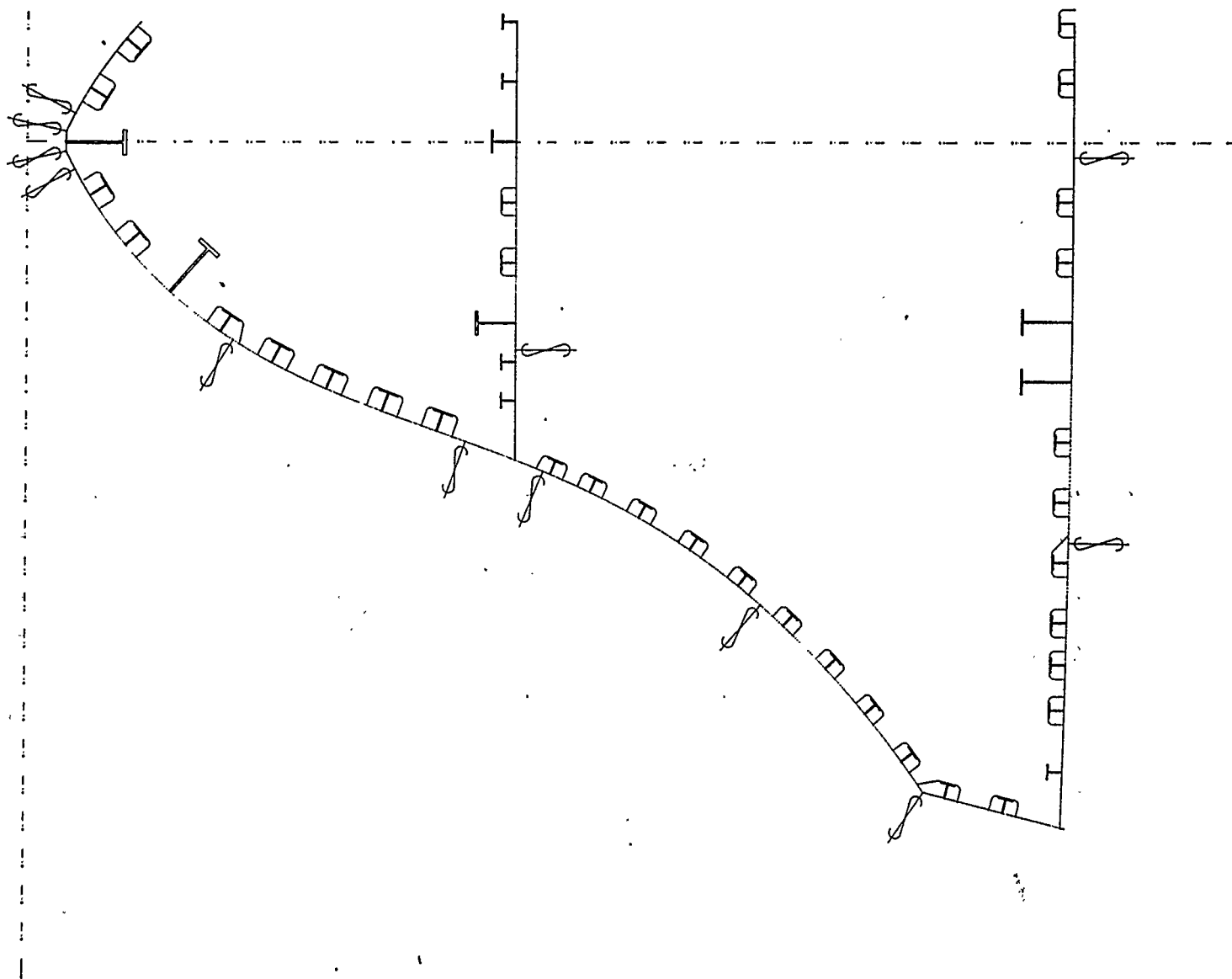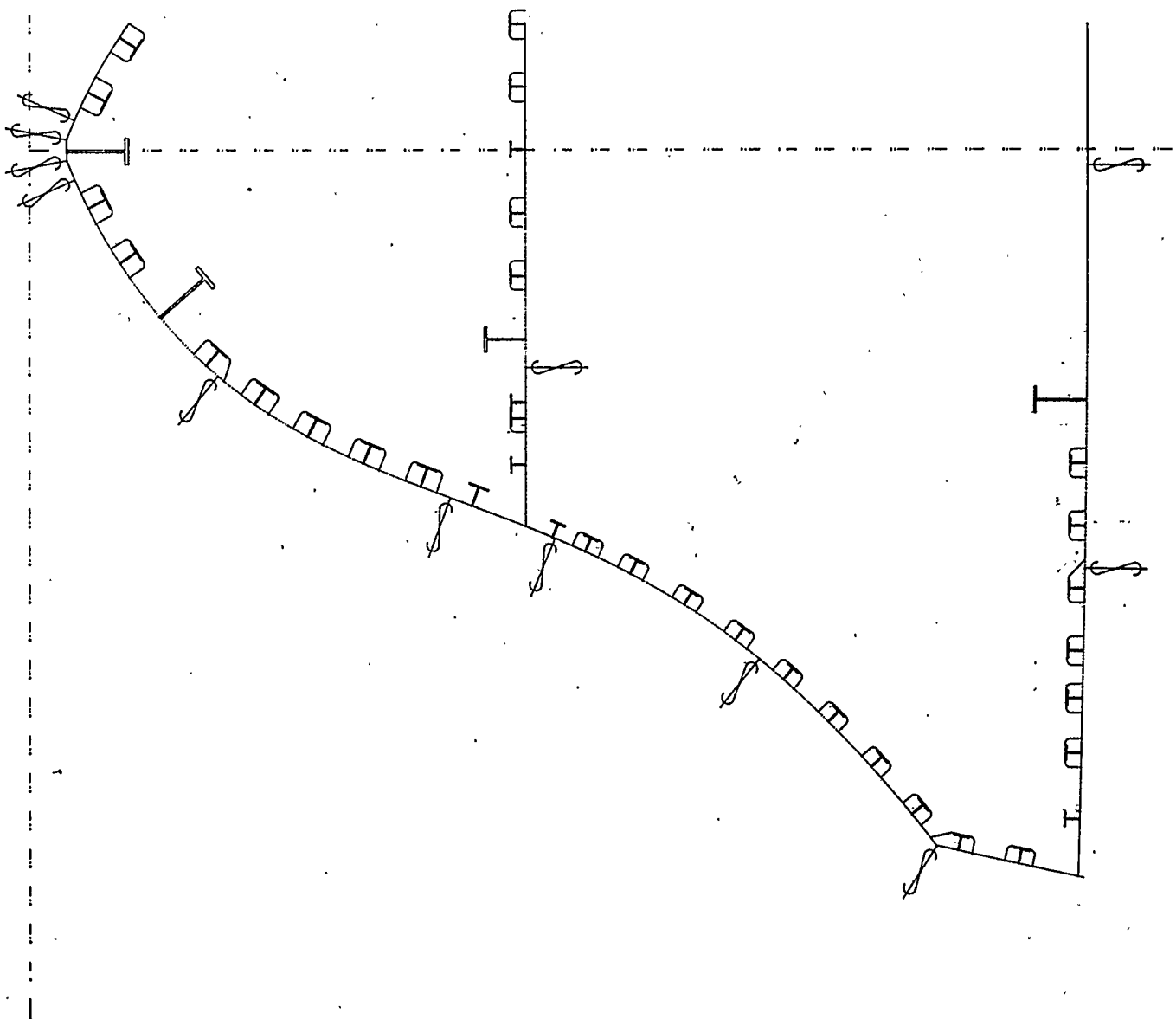STBD LOKG FWD PORT SIM OPP

Fig. 8

157

TAPE NO. 730011 — 1 F 26100

WEB FRAME

Fig. 9

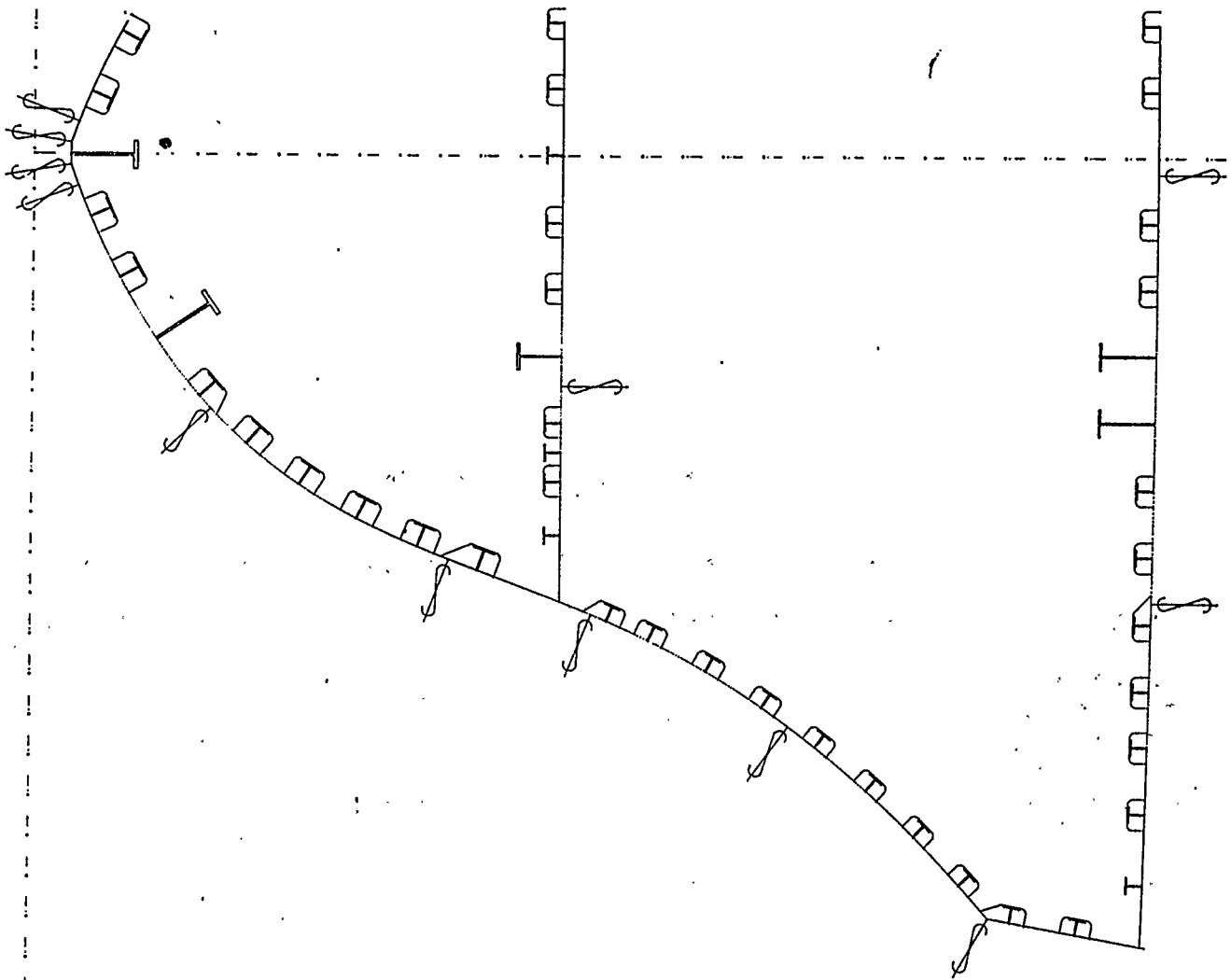STBD LOKG FWD PORT SIM OPP

158

TAPE NO. 731011 — 1 F 31000

WEB FRAME   STBD LOKG FWD PORT SIM   OPP

Fig. 10

159

TAPE NO.   732011   - 1 F   35100

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JOB PB01  PROG. DEMO                    INPUT 0012    REV. NO.   1        PAGE   1

INPS                    N     12                                      7300120012
DRWG TRSV        FWD    F 22                                          7300120016
RMKS BHD 22                                                          7300120020
STRT                         -2           -14                         7300120024
WRIT3                        -1 6          2        A -90          3  7300120028
WRIT3 WT BHD 22 - LKG FWD                                       *     7300120032
LOAD                   F 22          F 22                            7300120036
INPE                                                                  7300129999
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                          INPUT IS EXECUTABLE
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Fig. 11

WT BHD 22 - LKG FWD
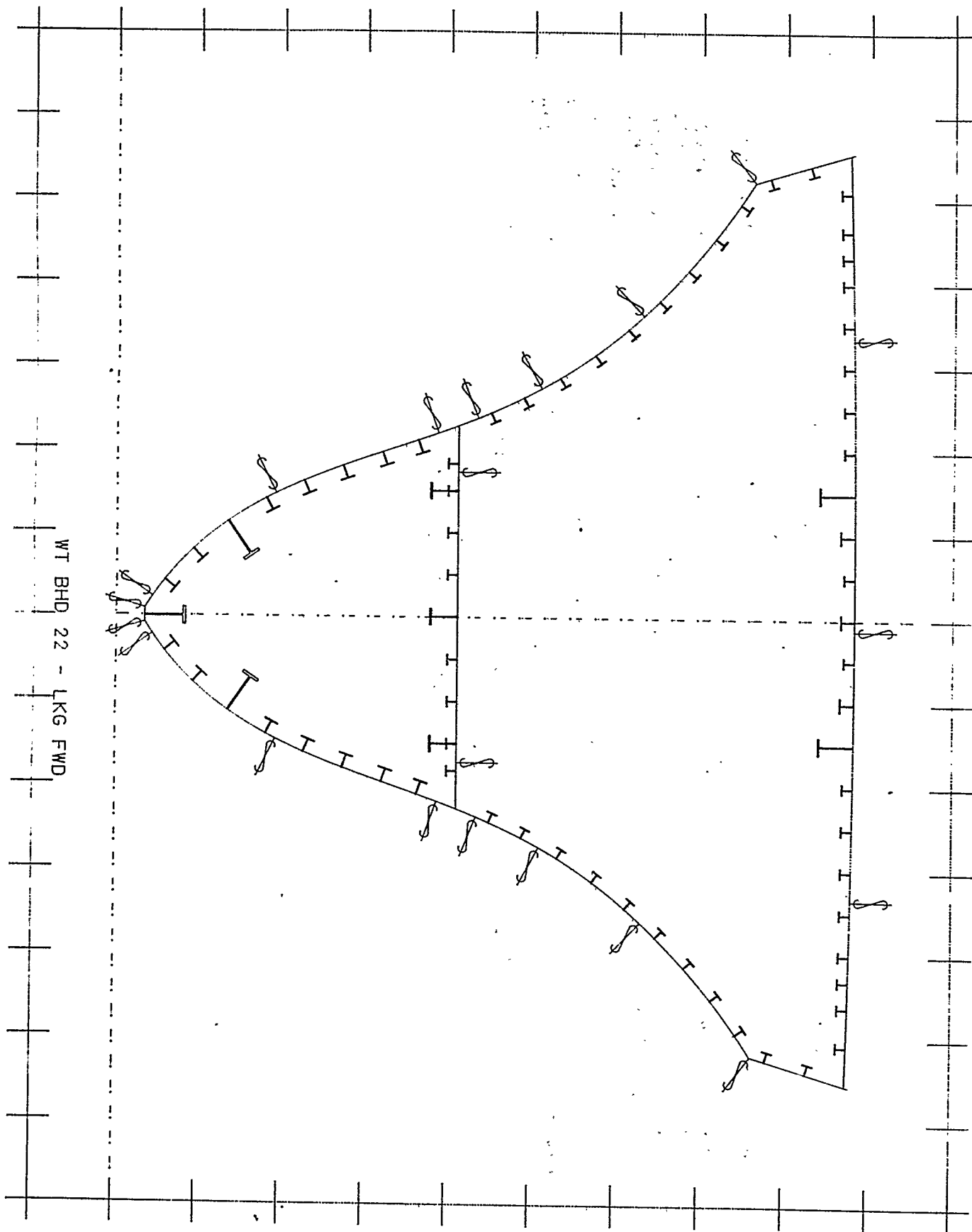
TAPE NO.   730012   - 2 F   22000   Fig. 12

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INPS                       N       1                                    7300010008
DRWG TRSV          FWD   F  7      F 12      F 17                        7300010016
RMKS WEBTFRMS. 7,12,17                                                  7300010020
STRT                               -14                                  7300010021
WRIT3                     -2 3              A -90            3           7300010022
WRIT3 WEB FRM.    LKG. FWD                            *                 7300010023
LOAD                    F  7      F 17                                  7300010049
INPE                                                                    7300019999
         1         2         3         4         5         6         7         8
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               INPUT IS EXECUTABLE
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Fig. 13

WEB FRM.   LKG. FWD

TAPE NO. 730001   -18 F   7000 Fig. 14

I.63

WEB FRM.   LKG. FWD

TAPE NO.   731001   −17 F   12000   Fig. 15

WEB FRM.   LKG. FWD

TAPE NO.   732001   -11 F   17000   Fig. 16

165

```
          1         2         3         4         5         6         7         8
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INPUT UPDATING            DATE  06/09/78    TIME  12/58/35     RUN NO.    9
JOB PB01   PROG. DEMO                  INPUT 0002    REV. NO.   11        PAGE   1

INPS                    N       2                                   7300020008
DRWG TRSV        FWD    F   7        F  12        F  17              7300020016C
RMKS WEBTFRMS. 7,12,17                                              7300020020
STRT                              -14                               7300020021
WRIT3                   -2 5                 A  -90          3       7300020022
WRIT3  WEB FRM.        LKG. FWD                             *       7300020023
MIDN                    N                                           7300020100
CNTR DOWNOUTP                                                       7300020104
SHEL2                   N            J  B        D MDK              7300020108
SHFT                        12                ANY-                  7300020112
                            12                ANY-                  7300020116
TRIM                    X  D PFF                                    7300020120
TRIM2                   X  D MDK                                    7300020124
CTRE      INNL          N        F                                  7300020128
CNTR DOWNOUTP                                                       7300020132
SHEL2                   N            J  B    S   D MDK    S          7300020136
SHFT                        12                ANY+                  7300020140
                            12                ANY+                  7300020144
TRIM                    X  D PFF                                    7300020148
TRIM2                   X  D MDK                                    7300020152
CTRE      INNL          N        S                                  7300020156
CNTR DOWNOUTP                                                       7300020160
DECK2                   D  MDK       P  END  S  P END   P           7300020164
SHFT                         6                ANX-                  7300020168
                             6                ANX-                  7300020172
TRIM                    Y  S L22  S                                 7300020176
TRIM2                   Y  S L22  P                                 7300020180
CTRE      INNL          D  MDK                                      7300020184
WRIT3                   D  MDK  S            A  -90          2       7300020188
WRIT3     MAIN DECK                                         *       7300020192
WRIT3                   D  PFF  S            A  -90          2       7300020196
WRIT3     PLATF. REF. 5                                     *       7300020200
LOAD                    F   7        F   7                          7300020202
ADDP                    S  CVK  C                20          1       7300020204
                        P       1                12          2       7300020208
                        P       2                12          3       7300020212
                        P       3                 6          4       7300020216
                        P       4                 6          5       7300020220
                        P       5                 6          6       7300020224
                        P       6                 6          7       7300020228
                        P       7                 6          8       7300020232
                        P       8                 6          9       7300020236
HOLE  DOAN              P       2           A    0                  7300020240
                            18           15                        7300020244
HOLE                    P       4                                   7300020248
                             6                                     7300020252
HOLE                    P       6                                   7300020256
                             6                                     7300020260
HOLE                    P       8                                   7300020264
                             6                                     7300020268
CNTR      CALC                                                      7300020272
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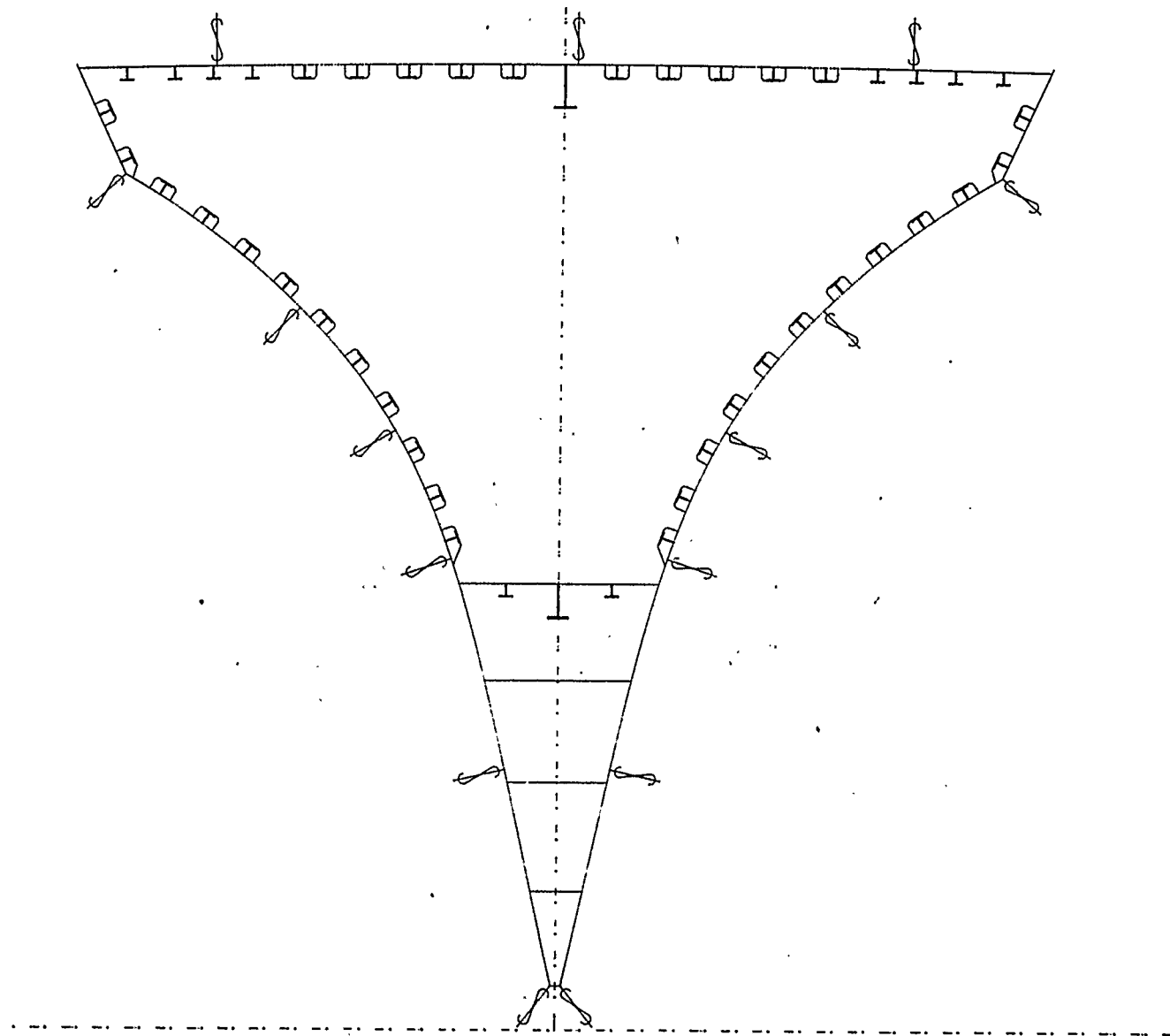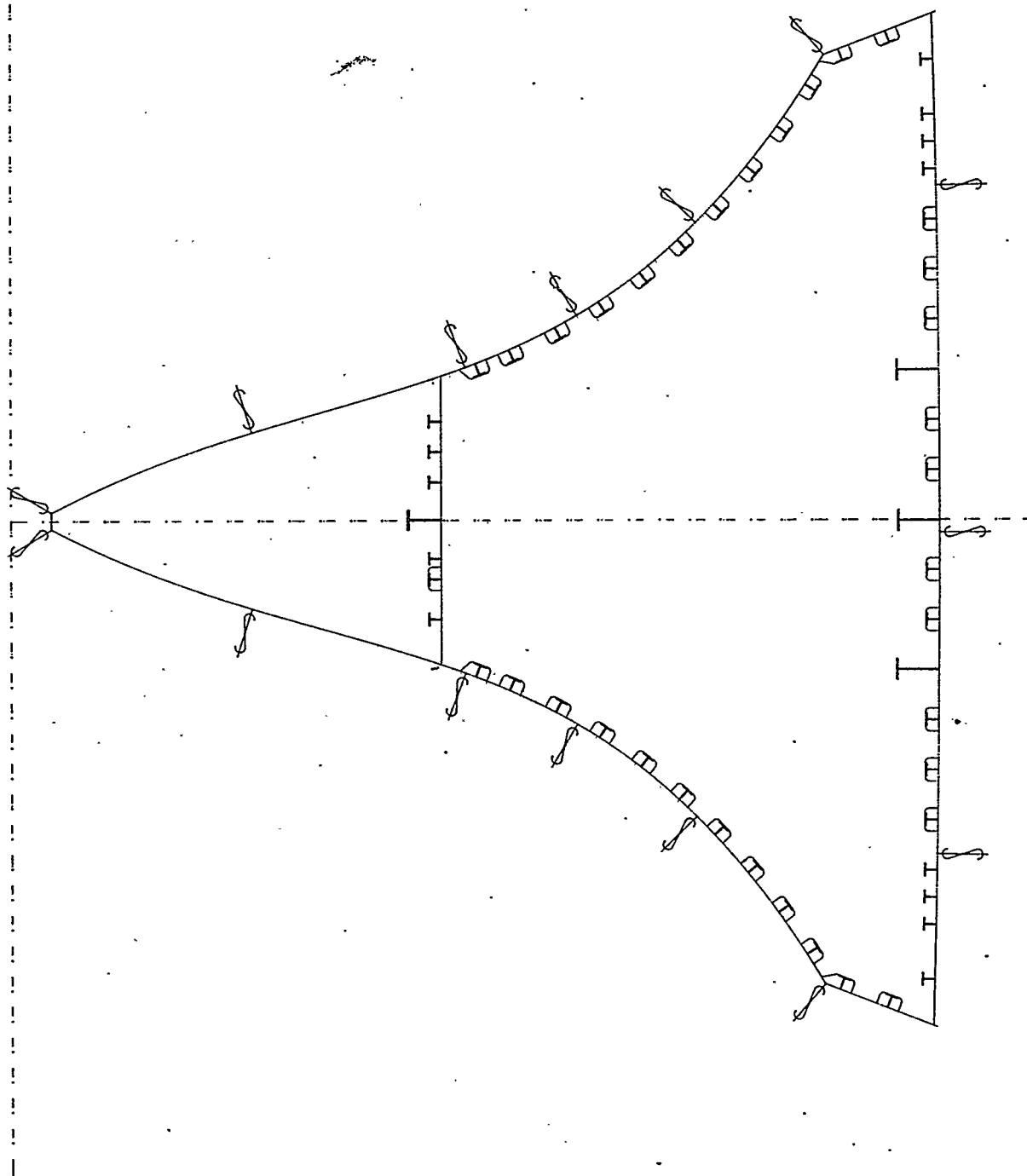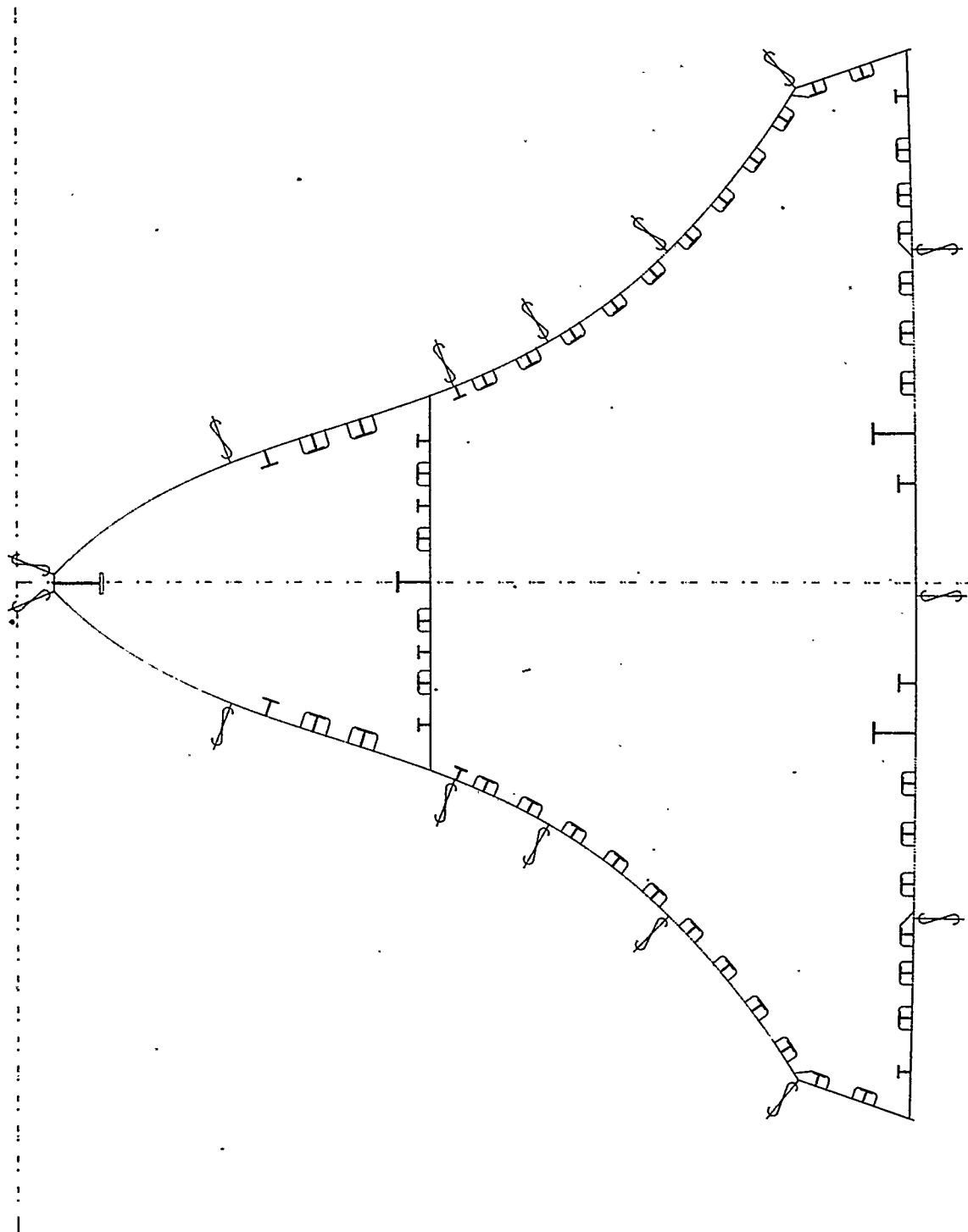
Fig. 17A

166

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     JOB P801  PROG. DEMO               INPUT 0002    REV. NO.  11          PAGE   2

     SHEL            P+    M                                      7300020276
     SLPE2                 XX    1                              1 7300020280
        2                 XX    3                              3 7300020284
        2                 XX    5                              5 7300020288
        2                 XX    7                              7 7300020292
        2                 XX    9                              9 7300020296
     CTRE       NOCT         M                                    7300020300
     PNCH3                 P     1           X        1-Y        1 7300020304
     PNCH3                 P     3           X        3-Y        3 7300020308
     PNCH3                 P     5           X        5-Y        5 7300020312
     PNCH3                 P     7           X        7-Y.       7 7300020316
     PNCH3                 P     9           X        9-Y        9 7300020320
     LOAD            F 12        F 17                             7300020400
     INPE                                                        7300029999
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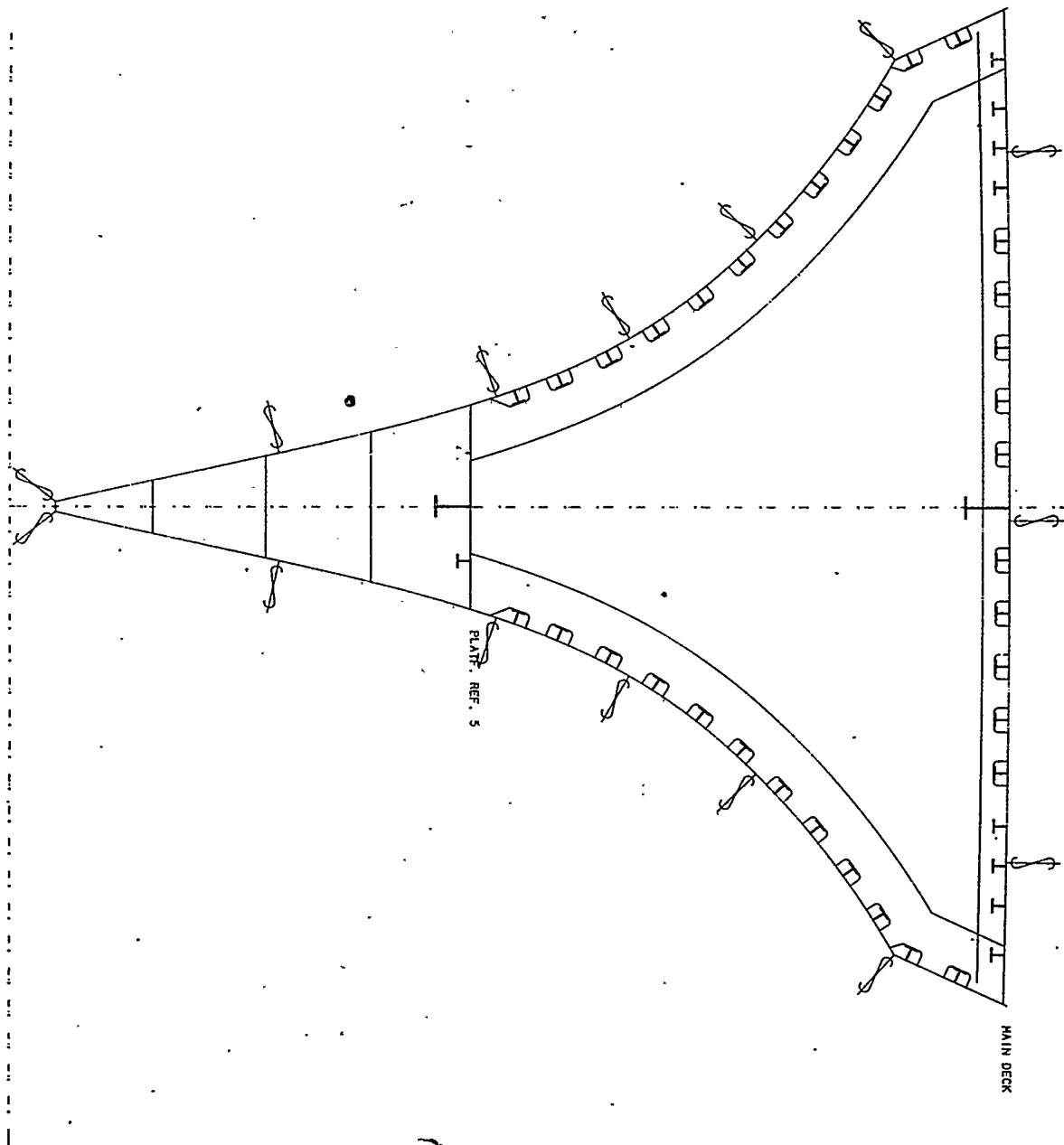
Fig. 17b

WEB FRM.   LKG. FWD

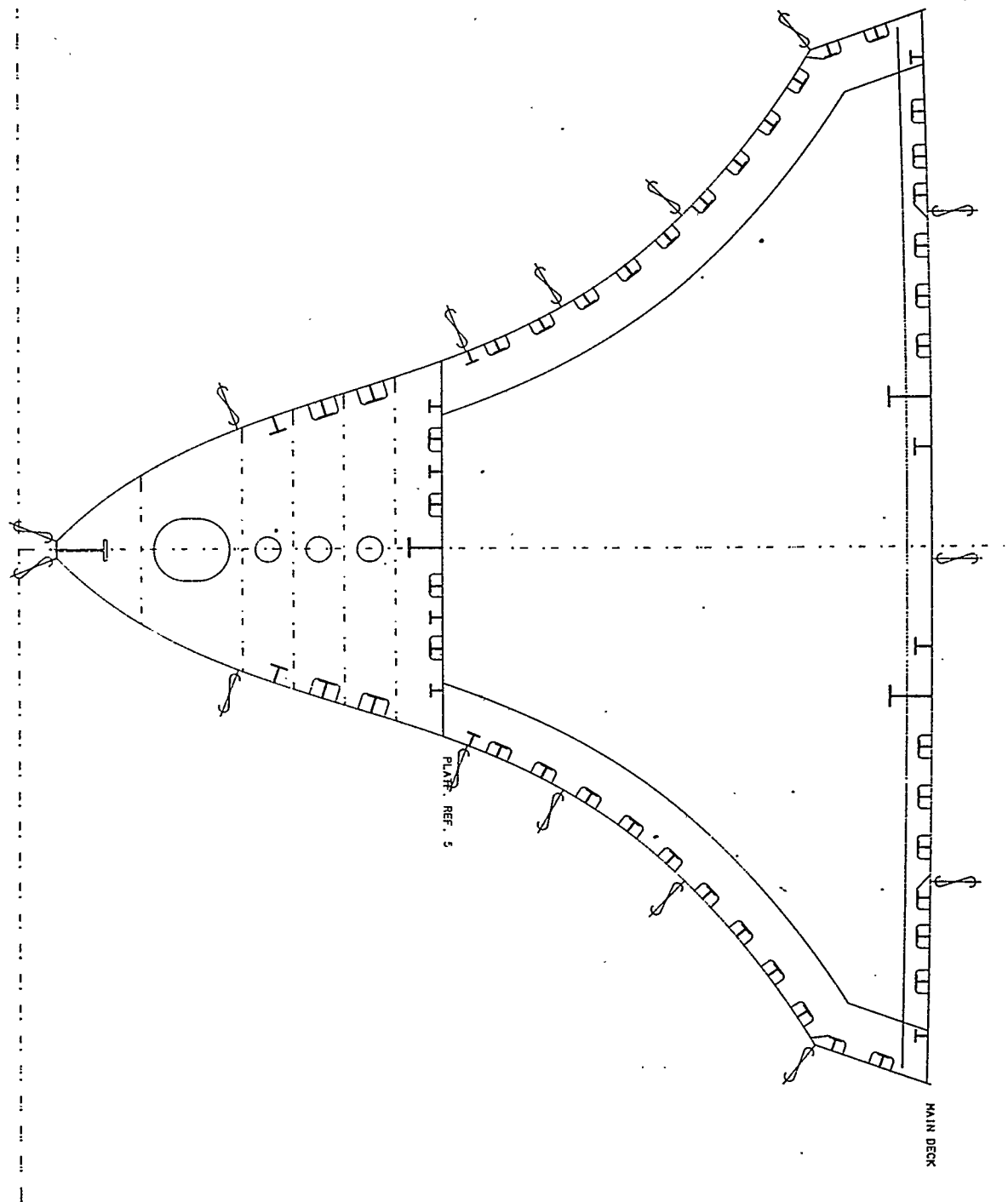TAPE NO.   730002   - 9 F   7000   Fig. 18

168

WEB FRM. LKG. FWD

PLATF. REF. 5

MAIN DECK
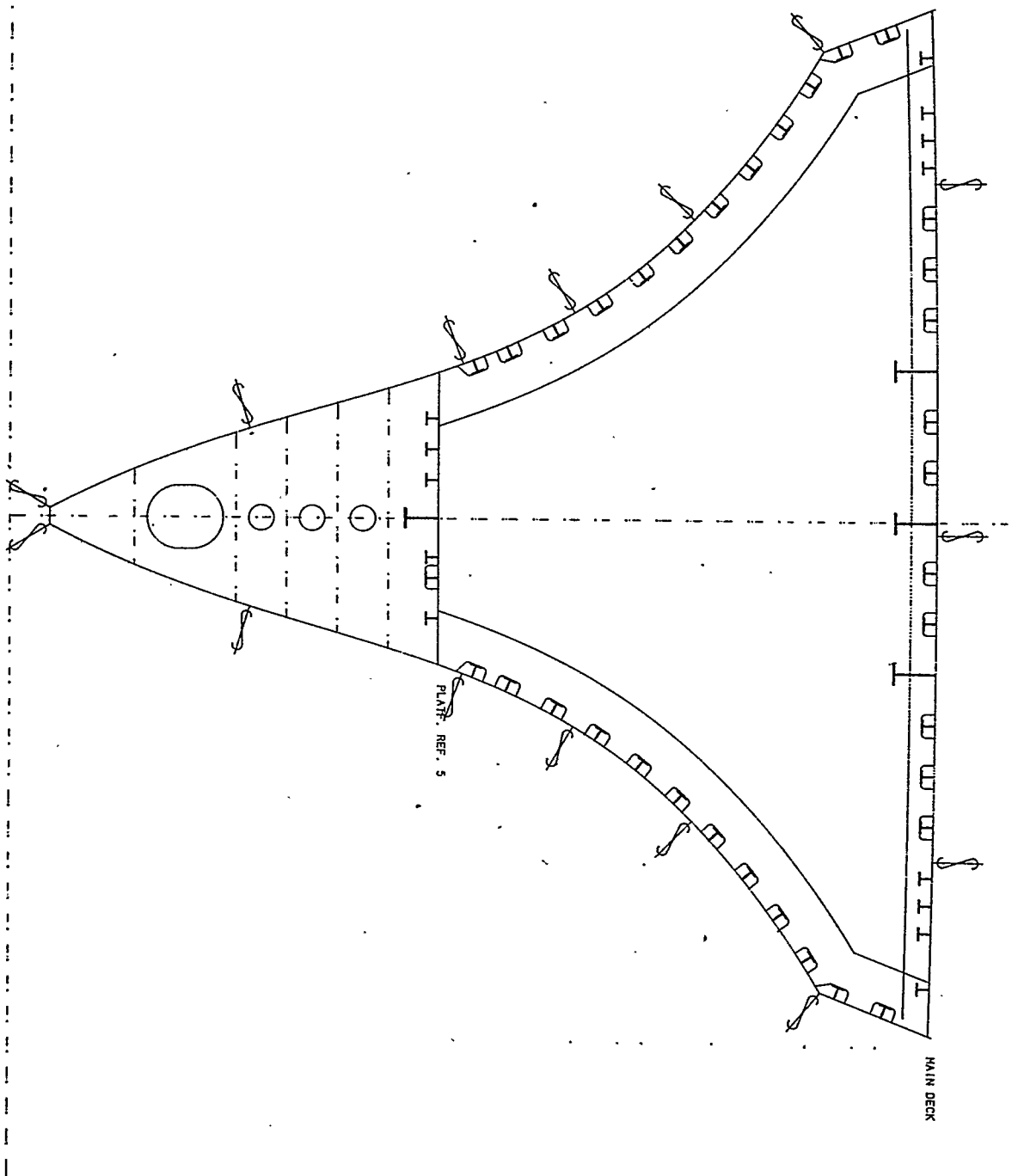
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169

WEB FRM.   LKG. FWD

PLATF. REF. 5

MAIN DECK

TAPE NO. 732002   - 3 F   17000P **Fig. 20**

170

```
              1         2         3         4         5         6         7         8
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     INPS                 N        4                                        7300040008
     DRWG TRSV       FWD  F  7        F 12        F 17                       7300040016
     RMKS WEBTFRMS. 7,12,17                                                 7300040020
     STRT                             -14                                   7300040021
     WRIT3                -2 3                  A -90              3         7300040022
     WRIT3 WEB FRM.       LKG. FWD                                 *        7300040023
     MION                 M                                                 7300040100
     ADOP                 D PFF  S                 1               11       7300040102
     LIMT                                   XX         11                   7300040103
     CNTR DOWNOUTP                                                          7300040104
     SHEL2                M           J B        D MDK                      7300040108
     SHFT                    12                ANY-                         7300040112
                             12                ANY-                         7300040116
     TRIM             X D PFF                                               7300040120
     TRIM2            X D MDK                                               7300040124
     CTRE      INNL       M        P                                        7300040128
     CNTR DOWNOUTP                                                          7300040132
     SHEL2                M  .        J B     S  D MDK   S                  7300040136
     SHFT                    12                ANY+                         7300040140
                             12                ANY+                         7300040144
     TRIM             X D PFF                                               7300040148
     TRIM2            X D MDK                                               7300040152
     CTRE      INNL       M        S                                        7300040156
     CNTR DOWNOUTP                                                          7300040160
     DECK2                D MDK        P END  S  P END  P                   7300040164
     SHFT                     6                ANX-                         7300040168
                              6                ANX-                         7300040172
     TRIM             Y S L22  S                                           7300040176
     TRIM2            Y S L22  P                                           7300040180
     CTRE      INNL       D MDK                                            7300040184
                                                                          73000401880
                                                                          73000401920
     WRIT3                D PFF  S                 A -90              2     7300040196
     WRIT3    PLATF. REF. 5                                          *     7300040200
     LOAD                 F  7        F  7                                 7300040202
     ADOP                 S CVK  C                 20               1      7300040204
                          P        1              12               2      7300040208
                          P        2              12               3      7300040212
                          P        3               6               4      7300040216
                          P       ·4               6               5      7300040220
                          P        5               6               6      7300040224
                          P        6               6               7      7300040228
                          P        7               6               8      7300040232
                          P        8               6               9      7300040236
     HOLE DOWN            P        2            A   0                      7300040240
                                 18         15                            7300040244
     HOLE                P        4                                       7300040248
                                  6                                       7300040252
     HOLE                P        6                                       7300040256
                                  6                                       7300040260
     HOLE                P        8                                       7300040264
              1         2         3         4         5         6         7         8
     12345678901234567890123456789012345678901234567890123456789012345678901234567890
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Fig. 21a

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            1          2          3          4          5          6          7          8
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                                       6                                        7300040268
   CNTR     CALC                                                               7300040272
   SHEL              P+     M                                                  7300040276
   SLPE2                XX      1                                          1   7300040280
       2                XX      3                                          3   7300040284
       2                XX      5                                          5   7300040288
       2                XX      7                                          7   7300040292
       2                XX      9                                          9   7300040296
   CTRE     NOCT           M                                                   7300040300
   PNCH3                P     1          X        1-Y         1             7300040304
   PNCH3                P     3          X        3-Y         3             7300040308
   PNCH3                P     5          X        5-Y         5             7300040312
   PNCH3                P     7          X        7-Y         7             7300040316
   PNCH3                P     9          X        9-Y         9             7300040320
   LOAD               F  12       F  17                                       7300040400
   INPE                                                                       7300049999
            1          2          3          4          5          6          7          8
   1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890

              SEVERITY = 0    INPLT IS STORED WITH REV. =    3


                         INPUT IS EXECUTABLE



                              Fig. 21b
```
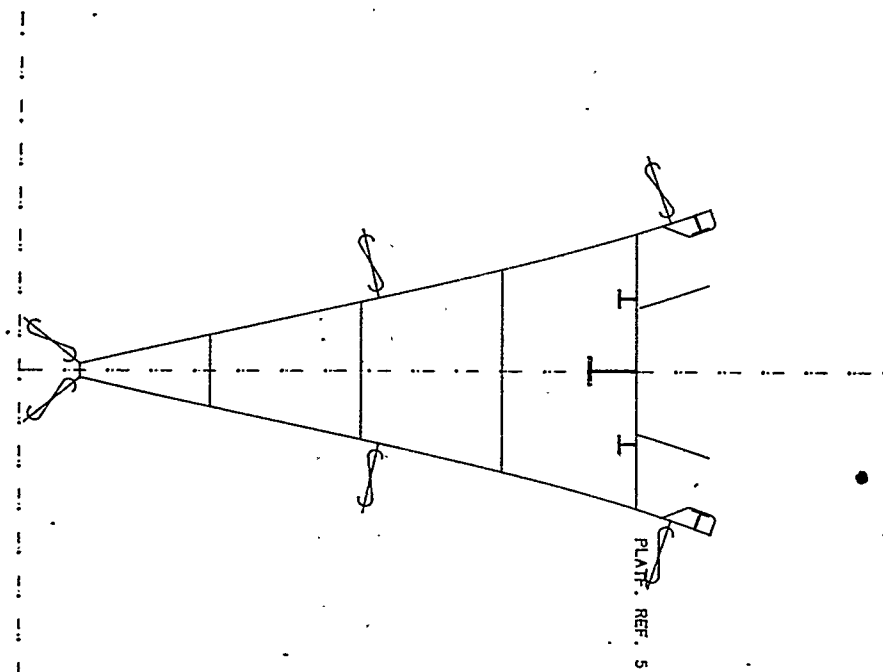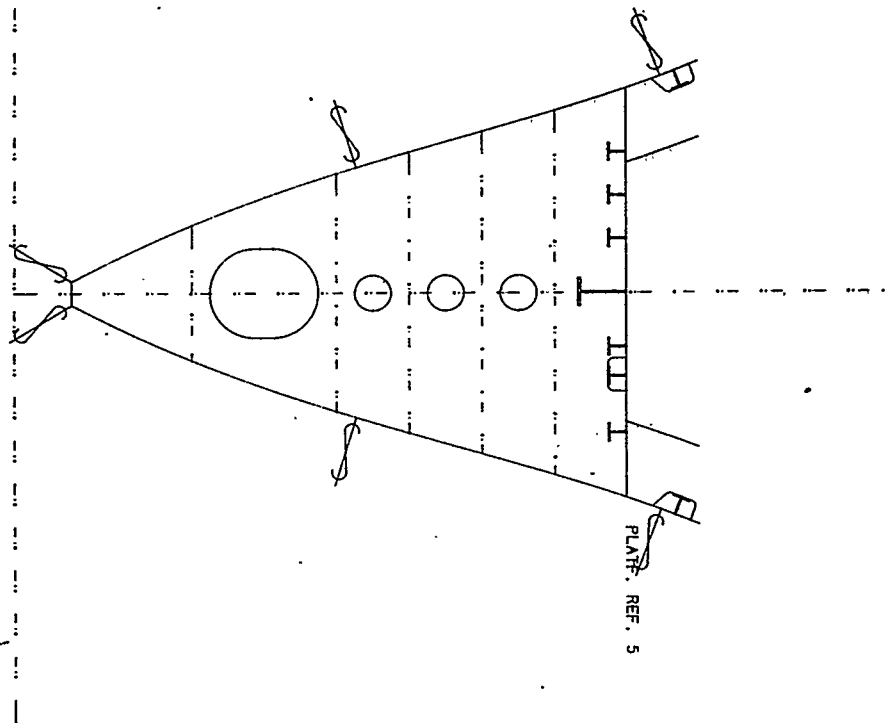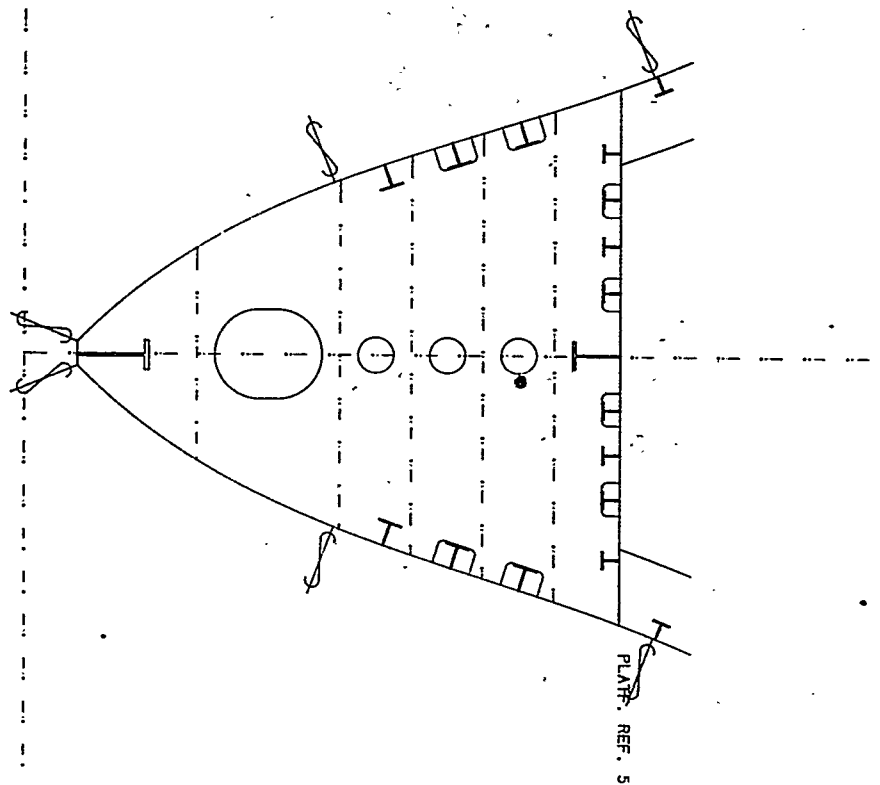
172

WEB FRM.   LKG. FWD

PLATF. REF. 5

TAPE NO.   730004   - 1 F   7000

Fig. 22

WEB FRM.　　LKG. FWD

PLATE. REF. 5

TAPE NO.　731004　- 1 F　　12000P

Fig. 23

174

WEB FRM.   LKG. FWD

PLATE. REF. 5

TAPE NO.   732004   - 1 F   17000P

Fig. 24.

175

```
              1         2         3         4         5         6         7         8
     12345678901234567890123456789012345678901234567890123456789012345678901234567890

     INPUT UPDATING          DATE  06/13/78    TIME  22/41/25      RUN NO.    9
     JOB PB01  PROG. DEMO                  INPUT 0003    REV. NO.   9         PAGE   1

     INPS                    N        3                                      7300030008
     DRAG TRSV        FWD    F  7                                            7300030012
     RMKS DETAIL 14 D                                                        7300030016
     MION                    M                                               7300030020
     ADOP                    J F      S                12        06      1    7300030024
                            J F      S               -12        24      2    7300030028
                            J F      S               -12       -12      3    7300030030
     LIMT                   XX       3YY       3XX         1YY         1     7300030032
     STRT                   P        3                                       7300030034
     WRIT3                  P        2          A -90              012       7300030036
     WRIT3DETAIL 14D  SCALE3IN = 1FT                              *          7300030040
     LOAD                   F  7        F  7                                 7300030044
     INPE                                                                    7300039999
              1         2         3         4         5         6         7         8
     12345678901234567890123456789012345678901234567890123456789012345678901234567890

              SEVERITY = 0     INPUT IS STORED WITH REV. =   10


                            INPUT IS EXECUTABLE
```

Fig. 25

DETAIL 14D SCALE 3IN   1FT
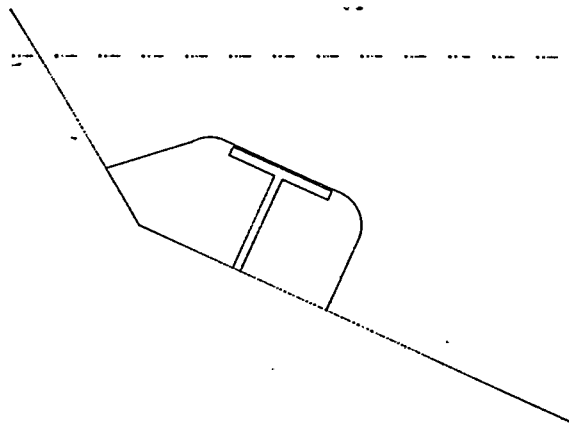
TAPE NO. 730003   − 8 F   7000

Fig. 26

```
        1         2         3         4         5         6         7         8
1234567890123456789012345678901234567890123456789012345678901234567890123456789 0

INPUT UPDATING            DATE  06/09/78     TIME  08/26/06      RUN NO.    6
JOB PB01  PROG. DEMO                      INPUT 0005    REV. NO.   6        PAGE   1

INPS                    N       5                                      7300050008
DRWG TRSV        FWD    F   7                                          7300050016
RMKS WEBTFRMS. 7,12,17                                                 7300050020
MIDN                    M                                              7300050100
ADDP                    D MDK  S                 -18          3       1  7300050104
ADDP                    D MDK  S                 1         -3       3   7300050105C
LIMT                    XX     1YY        3XX          3YY      1       7300050106
STRT                    X      1 Y        3                            7300050108
ADDP                    P      1                 -12               2   7300050112
WRIT3                   P      2          A -90              2         7300050116
WRIT3DETAIL 5B    SCALE  1IN = 1FT                              *      7300050120
CNTR DOWNOUTP                                                          7300050132
SHEL2                   M            J 8    S  D MDK  S                7300050136
SHFT                        12              ANY+                       7300050140
                            12              ANY+                       7300050144
TRIM                    X D PFF                                        7300050148
TRIM2                   X D MDK                                        7300050152
CTRE      INNL          M      S                                       7300050156
CNTR DOWNOUTP                                                          7300050160
DECK2                   D MDK     P END  S  P END  P                   7300050164
SHFT                         6              ANX-                       7300050168
                             6              ANX-                       7300050172
TRIM                    Y S L22 S                                      7300050176
TRIM2                   Y S L22 P                                      7300050180
CTRE      INNL          D MDK                                          7300050184
WRIT3                   D MDK  S          A -90              2         7300050188
WRIT3    MAIN DECK                                              *      7300050192
LOAD                    F   7      F   7                               7300050202
INPE                                                                   7300059999
        1         2         3         4         5         6         7         8
1234567890123456789012345678901234567890123456789012345678901234567890123456789 0

          SEVERITY = 0     INPUT IS STORED WITH REV. =   7


                      INPUT IS EXECUTABLE
```
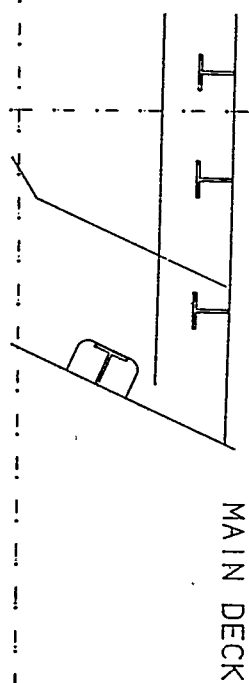
178

DETAIL 5B SCALE 1IN 1FT

MAIN DECK

TAPE NO. 730005 - 4 F 7000

Fig. 28

179

```
                1         2         3         4         5         6         7
       1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234 567 8 6

       INPUT UPDATING          DATE  06/09/78     TIME  16/36/56      RUN NO.      7
       JOB OILR  PROG. DEMO                     INPUT 0018    REV. NO.  11        PAGE    1

       INPS            16TH      N      0018                                          7300130000
       RMKS BAUER TEST DEMO                                                          7300190020
       LIMT                      X     -1      YF  -  01   X     50      Y    45      7300160112
       STRT                             0           -1                               7300180113
       DRWG TRSV          FWD     F 30         F 31                                   7300180116
       ADDP                      20       D    310 9                             3    7300180120
       LINE FAST                 P         3                                         7300190122
       CNTR DOWNOUTP                                                                 7300180132
       DECK              P+      D MDK                                               7300180136
       SHFT                      2 9               A 180                             7300180142
                                 2 9               ANX-                              7300180144
       SAVE                                                                    1     7300190148
       LINK       NEW                                                                7300160152
       SHEL              P-      M                                                   7300180156
       SHFT                      4 2               ANY-                              7300180160
                                 4 2               ANX+                              7300180164
       SAVE                                                                    2     7300180168
       LINK       NEW                                                                7300160172
       MANU                      P         3                                         7300180176
       LINE                     100      Y         3                                 7300190180
       ENDM                                                                          7300180184
       LINK       RND               4 014                                            7300180186
       CALL                                                                    1     7300160192
       LINK       RND               4 014                                            7300180200
       CALL                                                                    2     7300160204
       LINK       RND               4 614                                            7300190208
       MANU                     -20      Y         3                                 7300180212
       LINE                      P         3                                         7300160216
       ENDM                                                                          7300180220
       CTRE  HOLD                H 101                                               7300180224
       LOAD                      F 30         F 31                                   7300160257
       INPE       STOR                                                              7300189990
                1         2         3         4         5         6         7        8
       1234567890123456789012345678901234567890123456789012345678901234567890123456789012345 67 0

                SEVERITY = 0      INPUT IS STORED WITH REV. =  12
```

Fig. 29a

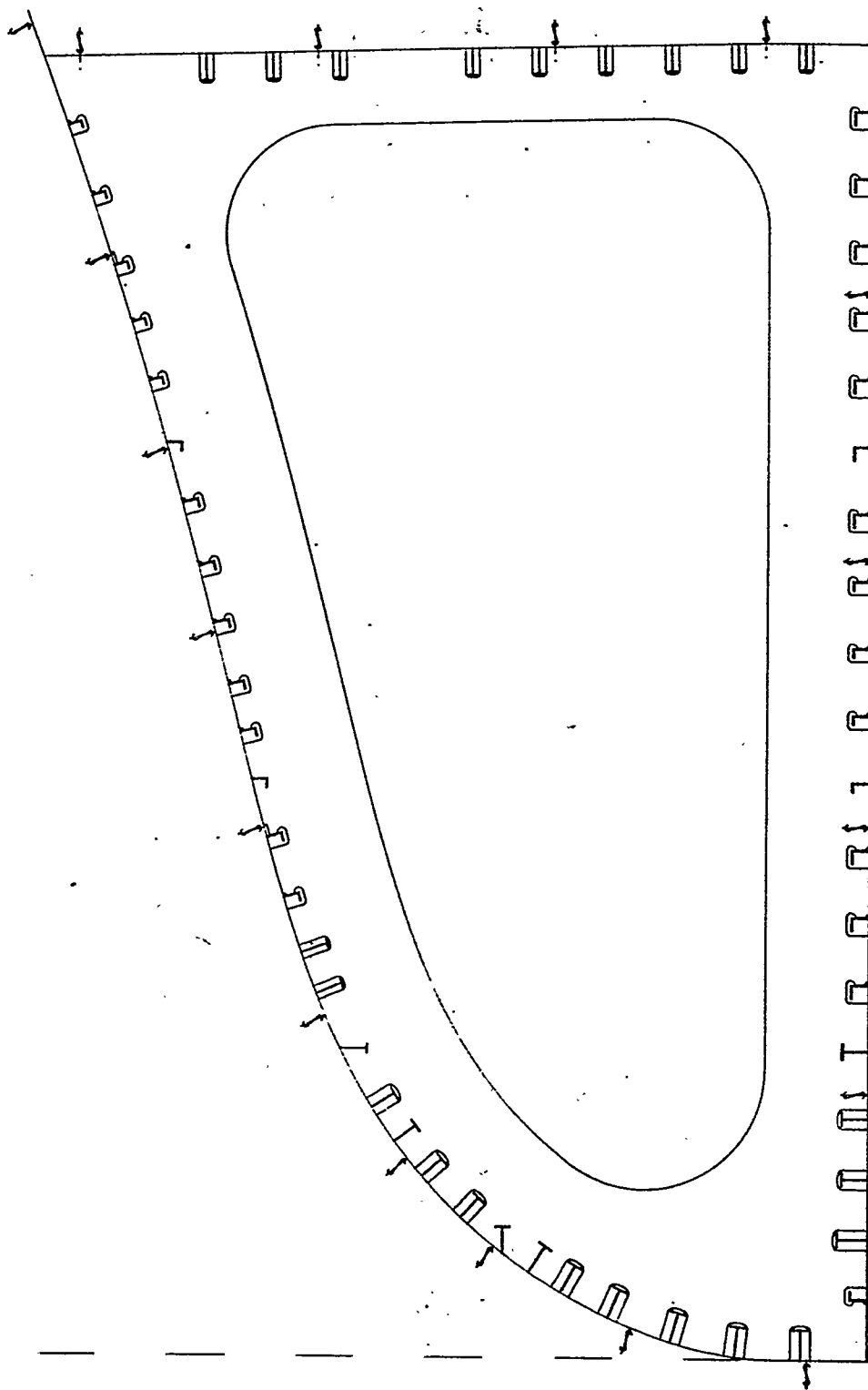Fig. 29b

TAPE NO. 730018   - 3 F   30000

Fig. 29c

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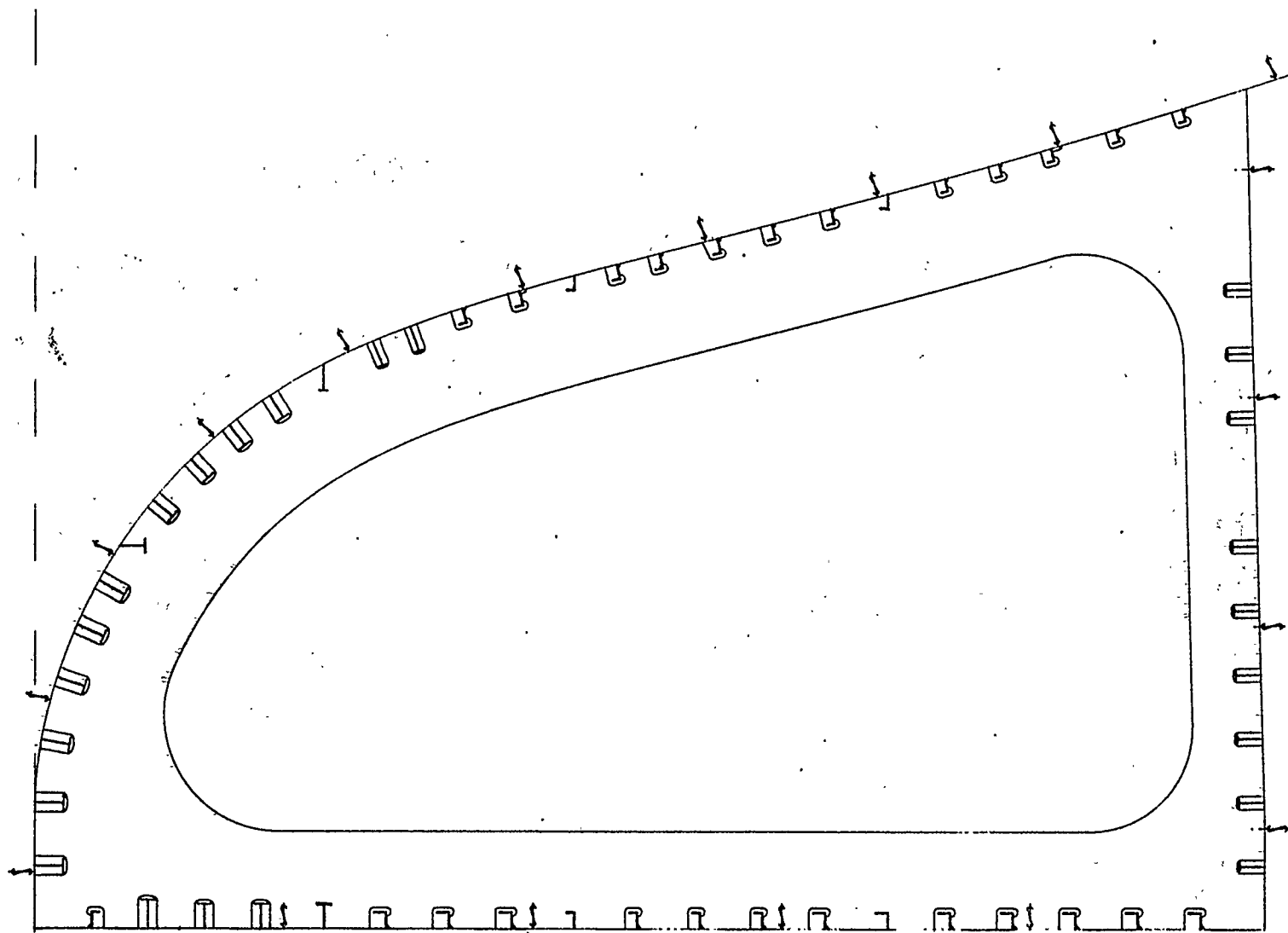TAPE NO. 731018 - I F 31000

```
         1         2         3         4         5         6
123456789012345678901234567890123456789012345678901234567890123456

INPUT UPDATING          DATE  06/14/78     TIME   16/36/22     RUN N
JOB WATR   PROG. DEMO                  INPUT 0001    REV. NO.   ?0

INPS WATR              N     0001
LIMT                   X    -1    Y   -11     X    25    Y    55
DRWG TRSV        FWD   F  96
STRT                      0         -12
RMKS BAUER TEST DEMO
HOLE                     14 3        -9 6    A    0
                          7            15
                         13 3        12 6    A    0
                          7            15
                         13 6        18 6    A    0
                          5            15
                         14 3        21 6    A    0
                          5            15
                          3           1 8    A    0
                           23          15

MIDN              M
STPT              S    4                                        10
                  S    5                                        11
                  S    7                                        12
                  S    8                                        13
                  S   10                                        14

PNCH3                   20         11      P       10
   3                    20         14      P       11
   3                    20         20      P       12
   3                    20         23      P       13
   3                    20         29      P       14
LOAD                 F  96      F  96
INPE       STOR
         1         2         3         4         5         6
123456789012345678901234567890123456789012345678901234567890123456
```

SEVERITY = 0   INPUT IS STORED WITH REV. = 21
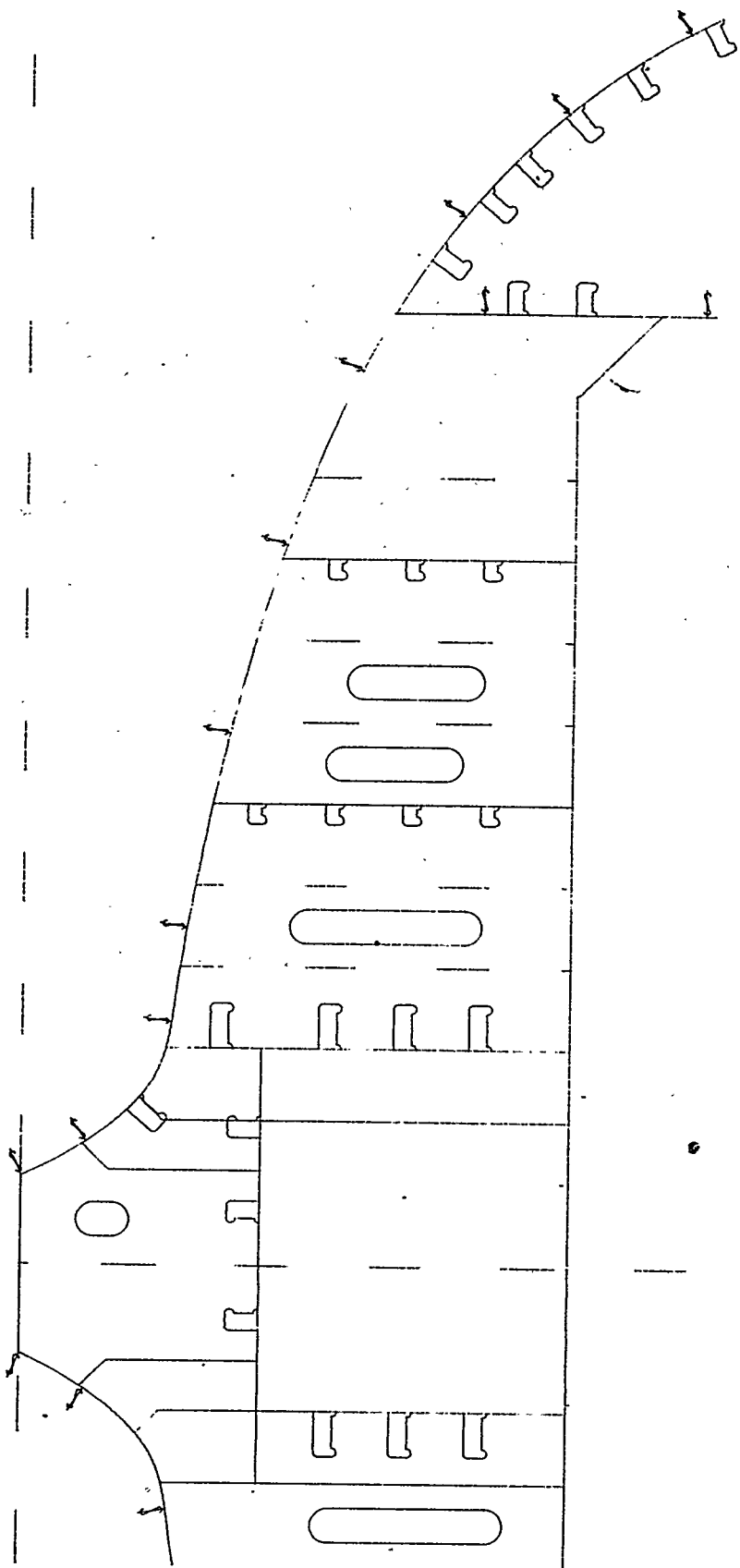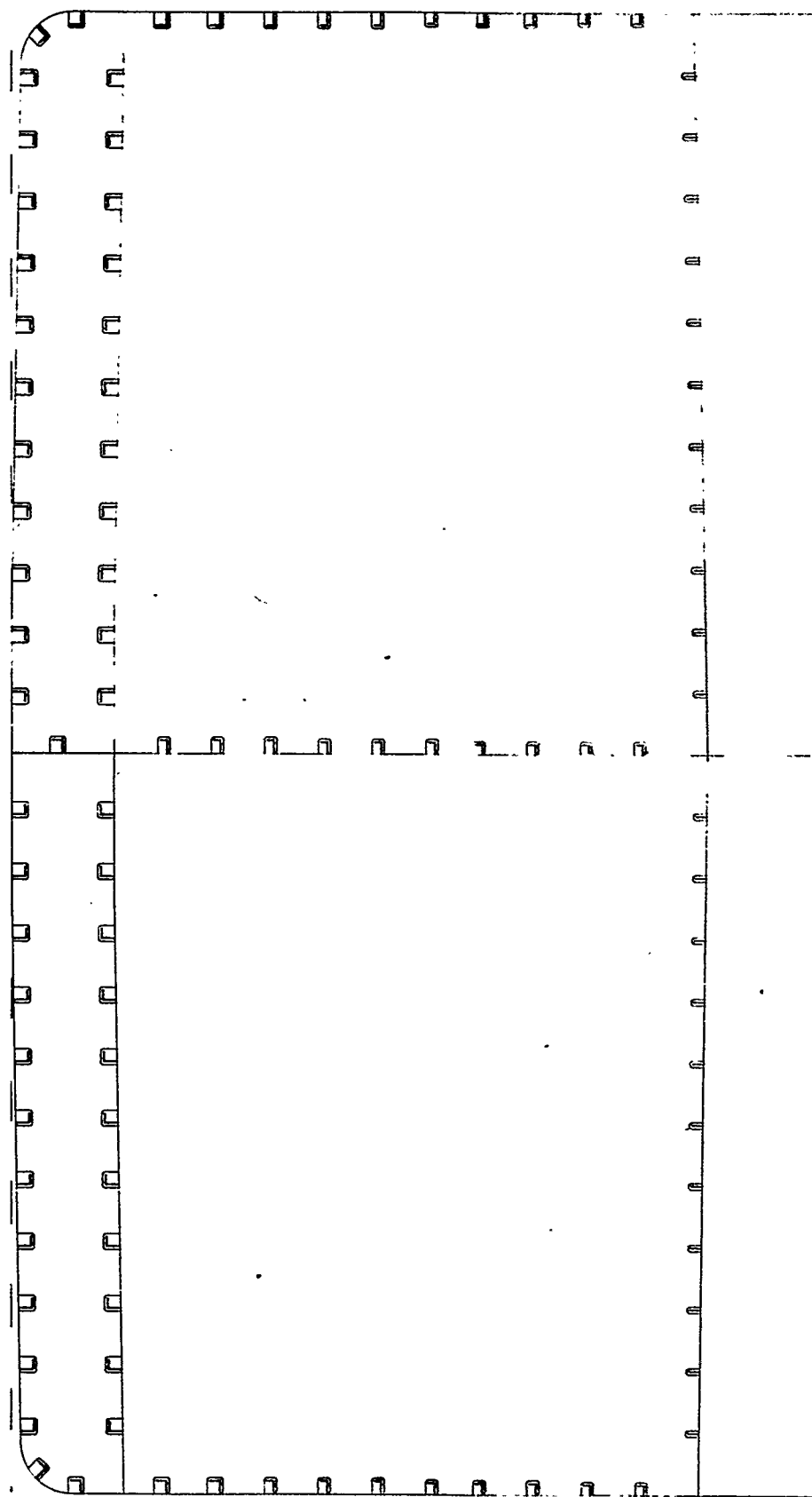

INPUT IS EXECUTABLE

Fig. 30a

Fig. 30b

TAPE NO.   830001   -10 F   96000

TAPE NO. 1131001 - 3 F 14000 Fig. 31

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